PERFORMANCE OF BOTTOM ASH TREATED PEAT SOIL IN REDUCING COMPRESSIBILITY

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ABSTRAK

Tanah gambut adalah tidak sesuai untuk tujuan pembinaan kerana sifat semulajadinya (kebolehmampatan tinggi, kekuatan ricih rendah dan kandungan air permulaan yang tinggi). Kajian ini dijalankan bagi mengenalpasti prestasi tanah gambut yang dirawat dengan Bottom Ash bagi mengurangkan kebolehmampatan. OPC digunakan sebagai pembolehubah yang dimalarkan iaitu sebagai pengikat kepada Bottom Ash dan juga simen. Bottom Ash digunakan sebagai pemboleh ubah manipulasi dalam setiap siri ujian makmal yang telah dijalankan. Kajian ini bertujuan bagi menentukan hubungan antara had pengecutan linear dan kandungan kelembapan tanah gambut sebelum dan selepas penstabilan, hubungan antara had pengecutan linear dan kandungan serat dengan kandungan organik dalam tanah gambut sebelum dan selepas penstabilan dan bagi mengukur kesan had penyusutan linear dalam mengurangkan penyelesaian sebelum dan selepas penstabilan. Beberapa ujian telah dilakukan bagi menentukan sifat kejuruteraan dan bagi mencapai objektif penyelidikan seperti ujikaji graviti tertentu, ujian nilai pH, kandungan air, kandungan serat, kandungan organik, dan had pengecutan linear. Hasilnya membuktikan bahawa Bottom Ash dapat digunakan sebagai salah satu agen penstabil dalam mengurangkan kebolehmampuan tanah gambut.

ABSTRACT

Peat soil is an unsuitable for construction purpose because of its natural properties (high compressibility, low shear strength and high initial water content). This research was done to study the performance of bottom ash treated peat soil in reducing compressibility. The specific amount of OPC (control variable) used as a binders and proportion of bottom ash (manipulate variable) in a series of laboratory test were conducted. This research aims were to determine the relationship between linear shrinkage limit and moisture content of the peat soil before and after stabilization, the relationship between linear shrinkage limit and the fiber content with organic content in peat soil before and after stabilization and to measure the effects of linear shrinkage limit in reducing settlement before and after stabilization. Several test has been done to determine the engineering properties and to obtain the objective of the research such as specific gravity test, pH value test, water content, fiber content, organic content, and linear shrinkage limit. The results proved that Bottom Ash could be used as one of the stabilization agent in reducing the compressibility of the peat soil.

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LIST OF ABBREVIATIONS AND SYMBOLS

ASTM	American Society for Testing and Materials
BA	Bottom Ash
BS	British Standard
Cc	Compression Index
$C\alpha$	Coefficient of Secondary Compression
FC	Fiber Content
LS	Linear Shrinkage
OC	Organic Content
OPC	Ordinary Portland Cement
δ_c	Settlement due to consolidation

CHAPTER 1

INTRODUCTION

1.1 Introduction and Background of Study

In Malaysia, Sarawak has the largest area of peat land which is about 1.66 million hectares (Huat, Kazemian, Prasad, & Barghchi, 2011). Whereas in Peninsular Malaysia, Pekan Forest Reserve has the largest peat block with an area of 59,097 ha (Lopez, 2010). Peat is an accumulation of partially decomposed and disintegrated plant remains under conditions of incomplete aeration and high water content (Kalantari & Prasad, 2014). Peat is an organic soil which consists more than 70% of organic matters (Duraisamy, Huat, & Aziz, 2007). The formation of peats is favourable when the area is waterlogged, with low permeability ground, excess rainfall and irrespective of altitude or latitude (Huat, Prasad, Asadi, & Kazemian, 2014). Its structure ranges from more or less decomposed plant remains to a fine amorphous, colloidal mass (Cumming & Finlay, 2006). The peat soil is classified as problematic soil. This is due to its natural properties of high water content, high compressibility, low shear strength, high degree of variability in the same location, and potential for further decomposition as a result of changing environmental conditions (Celik & Canakci, 2014). Usually peat area related with swampy and normally low shear strength region and high compressibility is significant and often related to problematic soil for construction purposes such as highly secondary settlement and stability problem may occur when the structure is built on the peat soil (Moayedi & Nazir, 2017). There are many methods to enhance the strength properties of the peat for future development in the country like Malaysia such as chemical stabilization, cement stabilization and fibre reinforcement. The main purposes here is only for construction reliability only and not considering the environmental effects. In this research, bottom ash was used to stabilize the peat soil. This stabilization method involves the mechanical mixing of cementitious compound such as Ordinary Portland Cement (OPC) with peat soil.

1.2 Problem Statement

Peat soil is considered as problematic soil due to its natural properties of high moisture content, high compressibility and water holding capacity, low specific gravity, low shear strength and medium to low permeability (Kolay, Sii, & Taib, 2011). It is unsuitable for the engineer to construct the structure like foundations and buildings on it. This is because construction poses problems like high secondary settlement and stability problem may occur when the structure is built on the peat soil. Usually, construction on peat soil is the last option for developer and also engineer as the effectiveness of existing treatment is still questionable and it is very costly. Unfortunately, due to the rapid development in country, lack of land for construction becomes problems. Hence, it is essential and important for the future of this country development by getting the right solution for the stabilization work and improving the peat soil. The properties of peat soil must be clearly understood in order to improve the properties of peat.

Nowadays, many methods have been introduced in order to stabilize and improve the soil such as mechanical stabilization (improving properties of the soil by changing its gradation) and stabilization by using different types of admixtures (such as Lime Stabilization, Cement stabilization, Chemical Stabilization and Fly ash Stabilization) (Afrin, 2017). However, some of them require high cost and yet the effectiveness of the ground improvement method is questionable. Thus, elements like cost, environmental friendliness, reliability, effectiveness and durability should be considered in selecting the best method of ground improvement.

Bottom ash used for the stabilization of the peat soil. It is one of the method for soft soil stabilization. In construction industry, OPC is combined with bottom ash for the peat stabilization because it has economically-friendly and good price-performance ratio. Unfortunately, OPC is highly not environmental friendly and it contributed to climate changes and global warming. For every tonne of cement production, its actually emit the same amount of carbon dioxide to the environment. The highest amount of carbon dioxide is actually from the production of cement which contributes to global warming (Damtoft, Lukasik, Herfort, Sorrentino, & Gartner, 2008).

1.3 Research Question/ Hypothesis

To overcome the already existing research problems and its gap, the proposed study aims to address the following research questions

- What is the effect of bottom ash toward the relationship of the linear shrinkage limit and moisture content of the peat soil before and after stabilization?
- What is the effect of peat consisting different proportion of OPC (5%) and Bottom Ash (5%, 10%, 15% and 20%) towards the relationship between linear shrinkage limit and fiber content with organic content in the peat soil before and after stabilization?
- What is the effects of linear shrinkage limit in reducing settlement before and after stabilization?

1.4 Overall Objective

The main purpose of this research is to study the performance of Bottom Ash treated peat soil in reducing compressibility

Specific Aims

1. To determine the relationship between linear shrinkage limit and moisture content of the peat soil before and after stabilization.
2. To determine the relationship between linear shrinkage limit and the fiber content with organic content in peat soil before and after stabilization.
3. To measure the effects of linear shrinkage limit in reducing settlement before and after stabilization.

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